REMARKS

The Office Action mailed December 9, 2009 has been carefully considered. Reconsideration in view of the following remarks is respectfully requested.

Claim Status and Amendment of the Claims

Claims 1-3 and 5-6 are currently pending.

No claims stand allowed.

Claim 4 was previously cancelled without prejudice or disclaimer of the subject matter contained therein.

The 35 U.S.C. § 103(a) Rejection

Claims 1, 3, and 5-6 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Boyd[1] in view of Bushberg et al.[2] and Udupa.[3] [4] This rejection is respectfully traversed.

According to the M.P.E.P.,

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant's disclosure.[5]

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[1] U.S. Patent No. 4,138,721 to Boyd.
[2] Bushberg et al., "The Essential Physics of Medical Imaging," 2002, ISBN 0-683-30118-7.
[3] Udupa, "Three-dimensional Visualization and Analysis Methodologies: A Current Perspective," 1999, Radiographics, Volume 19, Pages 783-806).
[4] Office Action at ¶ 3.
[5] M.P.E.P § 2143.

Furthermore, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.[6]

Claim 1 recites:

> A method for reconstructing a radiographic image of a large sized object by bits, the bits being crossed by a diverging radiation produced by a source, the radiation undergoing an attenuation, the attenuation being measured by a mono-dimensional or two-dimensional network of detectors on which the radiation projects, each measurement giving a projection vignette, the source as well as the network of detectors being displaced along the object at each measurement so that projection vignettes overlap, the method comprising a combination of the overlapping vignettes for reconstructing the image, as well as the following steps :
> discretising the object into voxels defining reconstruction heights;
> associating the voxels with at least one detector respective of the network on which the radiation projects after having crossed the voxel;
> allocating an attenuation value to each voxel according to the values measured by the associated detector; and
> combining the attenuation values of the voxels along parallel columns at the different reconstruction heights to obtain a two dimensional image.

[6] *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

The Examiner states:

> With respect to claim 1, Boyd discloses a method for reconstructing a radiographic image of a large sized object by bits, the bits being crossed by a diverging radiation produced by a source, the radiation undergoing an attenuation, the attenuation being measured by a monodimensional or two-dimensional network of detectors on which the radiation projects, each measurement giving a projection vignette, the source as well as the network of detectors being displaced along the object at each measurement so that projection vignettes overlap, the method comprising a combination of the overlapping vignettes for reconstructing the image (Figures 6 and 16), as well as the following steps:
>
> discretising the object into elements defining reconstruction heights (Col. 7, lines 41 -44 and Figures 6 and 12);
>
> associating the voxels with at least one detector respective of the network on which the radiation projects after having crossed the element (Col. 7, line 5 - Col. 8, line 4 and Figures 6 and 12-15);
>
> allocating an attenuation value to each element according to the values measured by the associated detector (Col. 7, line 5 - Col. 8, line 4 and Figures 6 and 12-15).
>
> Boyd fails to explicitly disclose voxels.
>
> Boyd further fails to disclose combining the attenuation values of the voxels along parallel columns at the different reconstruction heights to obtain a two dimensional image.
>
> Bushberg et al. teaches voxels (Figure 13-2).
>
> It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Boyd to include the voxel representation of Bushberg et al., since a person would have been motivated to make such a modification to improve imaging by providing the 2D CT image which corresponds to a 3D section of the patient with a third dimension which corresponds to the slice-thickness of the reconstructed image (Page 329, lines 6-14 and Figure 13-2) as implied by Bushberg et al.
>
> Udupa teaches combining the attenuation values of the voxels along parallel columns at the different reconstruction heights to obtain a two dimensional image Page 799, Col. 1, line 12 and Figure 20. Volume projection, where voxels are directly projected, or ray casting, where line traced perpendicular to the viewing plane. For patient laying on table, such as in Figures 1-4, 6 12, and 16 of Boyd, the projection image generated with either volume projection or ray casting techniques necessarily combines the attenuation values of the voxels along parallel columns at the different reconstruction heights to obtain a two dimensional image, i.e. a projection image.).

> It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the method of Boyd as modified above the combining of Udupa, since a person would have been motivated to make such a modification to improve an imaging procedure by allowing the three-dimensional seen be viewed on a two dimensional monitor as is always needed (Page 798, Col. 2, lines 8-1 1) as taught by Udupa.[7]

The Applicant respectfully disagrees. Contrary to the Examiner's statement, Udupa does not teach combining the attenuation of the voxels along parallel columns at the different reconstruction heights to obtain a two dimensional image. Udupa teaches processes which, either by the ray casting method or the voxel projection method, fail to suggest any combination of Udupa with the cited references. Udupa discloses three rendering techniques for obtaining a two dimensional image from three dimensional data. In the first rendering technique, MIP, Udupa discloses "the intensity assigned to a pixel [of the two dimensional image] is simply the maximum scene intensity encountered along the projection line,"[8] which means that a single intensity value of a selected voxel is used for the rendering, the other voxels being discarded.

In the surface rendering technique[9] disclosed by Udupa, an important step is the hidden part removal which includes "stopping at the first voxel encountered along each ray that satisfies the threshold criterion"[10] or alternatively in overwriting the shading value for each voxel in a projection line.[11] This amounts to a selection of a single voxel value.

Similarly, the value rendering technique disclosed by Udupa comprises a hidden part removal step.[12]

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[7] Office Action mailed December 9, 2009, at ¶ 2.
[8] Udupa at page 799, col. 1, ll. 13-15.
[9] Udupa at page 799, col. 1, l. 21 to page 799, col. 2, l. 36.
[10] Udupa at page 799, col. 2, ll. 25-27.
[11] Udupa at page 799, col. 2, ll. 30-36.
[12] Udupa at page 800, col. 2, ll. 11-13.

In all cases disclosed by Udupa, a voxel selection is made along columns, a combination of their values being excluded. The Applicant respectfully submits that such renditions exemplified by Udupa in which most of the information is discarded tend to select details of the object in the two-dimensional image. Whereas embodiments of the invention as presently claimed keep this information and project it on the image in order to get a more complete image of the object, which is achieved by the combining step.

The Applicant notes that the Examiner also cites Frieder et al.,[13] without reference to a particular claim.[14] Frieder et al. does not combine attenuation values of voxels along columns or other projection lines. Frieder et al. develops an "octree" method for encoding the connectivities between voxels in order to compress data.[15] Then a back-to-front technique is used for displaying the object. However, Frieder et al., either alone or in combination with the cited references, fails to disclose or suggest combining three dimensional data to obtain a two dimensional image.

For at least the above reasons, the Applicant respectfully submit the 35 U.S.C. § 103 rejection of Claim 1 based on Boyd in view of Bushberg et al. and further in view of Udupa is unsupported by the cited art of record and the rejection must be withdrawn.

Dependent Claims 3, 5, and 6

[13] Frieder et al., "Back-to-Front Display of Voxel-Based Objects", 1985, IEEE, Computer Graphics Applications, Volume 5, Issue 1, Pages 52-60.
[14] Office Action at p. 6.
[15] Frieder et al. at page 53, col. 1, ll. 13-22.

Claims 3, 5, and 6 depend from Claim 1. Claim 1 being allowable, Claims 3, 5, and 6 must also be allowable for at least the same reasons as for Claim 1.

The Second 35 U.S.C. § 103(a) Rejection

Claim 2 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Boyd in view of Bushberg et al. and Udupa, and further in view of Ribeiro et al.[16] [17] This rejection is respectfully traversed.

The arguments made above with respect to the 35 U.S.C. § 103 rejection of independent Claim 1 apply here as well. The 35 U.S.C. § 103 rejection of Claim 2 is unsupported by the cited art of record because the limitations of Claim 1 are not taught or suggested by Boyd in view of Bushberg et al. and Udupa. Accordingly, the 35 U.S.C. § 103 rejection of dependent claim 2 based on Boyd in view of Bushberg et al. and Udupa and further in view of Ribeiro et al. is also unsupported by the cited art of record because Boyd in view of Bushberg et al. and Udupa and further in view of Ribeiro et al. does not teach or suggest all claim limitations, and the rejection must be withdrawn.

Additionally, Claim 2 requires that the attenuation values of the voxels are combined by a digital combination on the group of voxels superimposed at the different reconstruction heights. This is not taught or suggested by the cited art of record.

[16] Ribeiro et al., "Tridimensional Image Reconstruction Method Based on the Modified Algebraic Reconstruction Technique and B-spline Interpolation," 1997, IEEE, Proceedings on Computer Graphics and Image Processing 1997, Pages 111-118).
[17] Office Action at ¶ 3.

In view of the foregoing, it is respectfully asserted that the claims are now in condition for allowance.

Conclusion

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

The Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Please charge any additional required fee or credit any overpayment not otherwise paid or credited to our deposit account No. 50-3557.

Respectfully submitted,
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